Instruction Manual

Model 312A

Super-Stable High Voltage Power Supply

Baird-Atomic, Inc.

33 UNIVERSITY ROAD • CAMBRIDGE 38, MASS.

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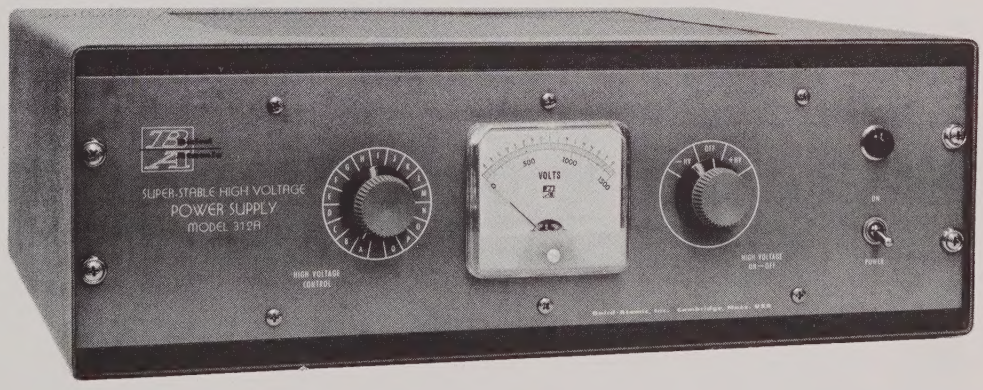

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SUPER-STABLE HIGH VOLTAGE POWER SUPPLY MODEL 312A

WARNING

Voltages as high as 4000 volts exist within this equipment. Contact with such voltage may prove fatal. Avoid accidental contact with any of the metallic 85A2 tube retainers which carry high voltage when the Power Supply is energized. EXTREME CAUTION should be exercised if the equipment is operated without protective cover screens. All high-voltage oil capacitors should be discharged prior to working on interior parts of this unit.

I. GENERAL DESCRIPTION

The Model 312A High Voltage Power Supply provides a highly stable d-c voltage source required for precision scintillation counting. Voltage drift has been reduced to an absolute minimum; it is possible to start an experiment a second time with virtually unchanged voltage conditions.

The Model 312A Power Supply consists of an input regulating transformer followed by a conventional high voltage transformer, rectifier, and R-C filter network. The filtered d-c voltage is applied to a bank of 17 cold cathode tubes from which the regulated output voltage is obtained.

In physical layout, the Model 312A Power Supply consists of a modular double-chassis assembly, panel mounted in a bottom and top-ventilated cabinet. The front panel carries the voltage indicating meter and all necessary operating controls. The entire assembly may be removed from its own cabinet and mounted in a standard 19-inch relay rack or cabinet.

SPECIFICATIONS

Range: 85V to 1,450V in 17 steps of 85V each.

Polarity: Choice of positive or negative output through the same connector by means of a front panel switch. This switch also allows the high voltage to be removed from the connector without turning off the supply.

Stability: 0.02% per day (e.g., at 1,020V, stability = 0.204V per day).

Line Regulation: .00035% per volt line change from 105V - 125V (3 parts per million per volt).

Load Regulation: Output voltage changes less than 0.35% for a load current increase from zero to maximum.

Ripple: Less than 0.01% of output voltage.

Internal Impedance: 5,000 ohms.

Maximum Current Output: 1 ma.

*Power Requirements: 110V, 60-cycle, at 0.25 amp.

Receptacle: Output MHV (JK-1).

Dimensions: 19" w x 5-1/4" h x 14" d.

Net Weight: 32 lbs.

Shipping Weight: 40 lbs.

II. OPERATION

Energize the equipment by throwing the POWER Switch to the ON position which also lights an indicator lamp.

Adjust voltage by means of the HIGH VOLTAGE CONTROL, a 17-position switch which increases the output high voltage with clockwise rotation in 17 equal steps. The HIGH VOLTAGE CONTROL step positions are lettered from A to Q to correspond with similarly marked positions on the front panel meter

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*(115V, 50 cycles or 220V, 50 cycles also available)

scale. This not only indicates the operating voltage but also serves to check correct functioning of the Power Supply.

The HIGH VOLTAGE ON-OFF control consists of a 3-position switch. The output voltage appearing at the HIGH VOLTAGE Connector is positive or negative with respect to chassis ground depending on whether the HIGH VOLTAGE ON-OFF control is turned to the +H.V. or -H.V. position. Turning this control to the OFF position removes output voltage from the HIGH VOLTAGE Connector and meter circuit without shutting off line power. Thus this control functions as a stand-by switch. Use this switch with care since application of reverse polarity can permanently damage some radiation detectors.

For maximum voltage stability, allow at least 1 hour, preferably 2, for warm-up. Operate at a reasonably constant temperature.

For quiet operation of the Power Supply, be certain that all screws used to fasten down chassis cover screens are tightened securely to prevent transmission of audible 60 cycle vibration from the voltage stabilizing transformer.

You may possibly note some drift in the front panel meter reading, but this will be limited to the 2% full-scale tolerance set by the meter manufacturer and drift in the meter circuit resistors. Such drift does not imply instability in the output voltage of the Model 312A Power Supply. Check the mechanical zero of the meter occasionally by turning the HIGH VOLTAGE ON-OFF Switch to the OFF position.

III. THEORY OF OPERATION

Block diagram, Figure 1, outlines the circuit in simplified form. Input regulating transformer T101 stabilizes against line voltage fluctuations. T101 in turn energizes high-voltage transformer T102 which, with V118, forms a conventional half-wave rectifier circuit. This is followed by a condenser input R-C filter arrangement. The filtered d-c voltage is dropped by limiting resistors R111 and R112 to supply ignition voltage to high-stability voltage reference tubes V101 to V117 inclusive. The regulating action of these gas-filled diodes results from the fact that the voltage across such tubes is practically independent of the current through them when the current range is restricted within certain specified limits. The entire d-c system is essentially balanced with respect to ground, depending upon the setting of S103.

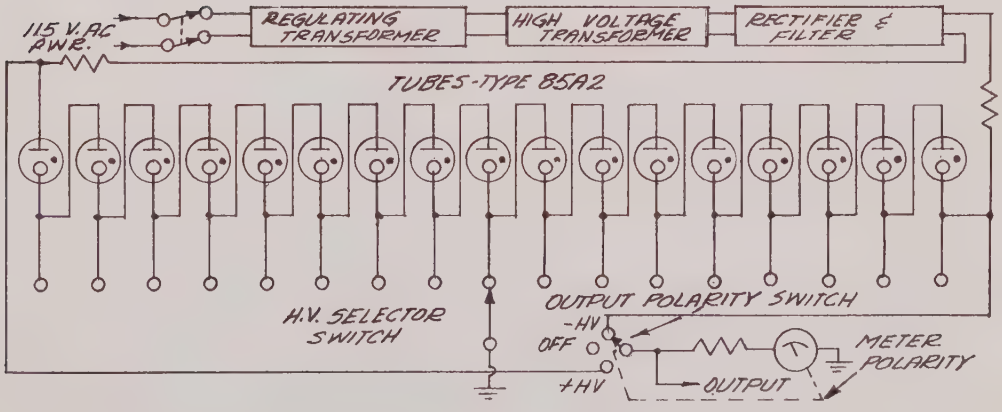


Figure 1 Block Diagram

Voltage output is adjustable in 17 steps of approximately 85 volts each by means of HIGH VOLTAGE CONTROL Switch S103 which varies the number of voltage reference tubes connected between the high-voltage jack and chassis ground. Achievement of day-to-day voltage reproducibility is aided by this fixed setting arrangement.

Output voltage polarity is controlled by the HIGH VOLTAGE ON-OFF switch S102. This switch reverses terminal connections on meter M101 to indicate correct voltage regardless of polarity and, in the OFF position, serves as a stand-by switch as explained in Section II.

M101, a 200-microampere meter paralleled for calibration purposes by R_x, indicates output voltage.

IV. MAINTENANCE

The most likely source of malfunctioning in this equipment is found in the series-connected bank of cold cathode tubes, V101 through V117. Failure of the 85A2 regulator tubes to ignite will be evidenced by a tendency for the front panel meter to read off-scale at the high end due to loss of regulation. In this case, turn the HIGH VOLTAGE ON-OFF Switch to OFF position to prevent meter damage. Locate the defective tube by shorting out one tube at a time, until the entire string of regulator tubes lights up, using a screwdriver with an insulated handle, between base pins #1 and #7. Replace the defective tube in the socket which was shorted out.

If more than one tube is defective, it may be necessary to short out small groups of regulator tubes using a technique similar to that outlined above. It is possible for a defective regulator tube to ignite and show an abnormally high anode-to-cathode voltage drop. Locate this type of defect

by indexing the HIGH VOLTAGE CONTROL through steps "A" to "Q" and noting on the front panel meter whether each step increases the output by approximately 85 volts. For example, if the HIGH VOLTAGE ON-OFF Switch is set at +H.V., and all HIGH VOLTAGE CONTROL positions preceding "K" show normal voltage increments, then an abnormal voltage increase at position "K" would indicate that V112 is defective.

A spare 85A2 tube is provided with each unit. In an emergency, type 5651 voltage reference tubes may be used in place of the 85A2 tubes -- at some sacrifice in voltage stability.

Table IV-1, Voltage and Resistance Measurements, and a Schematic Diagram are included to assist in isolating circuit faults and making repairs.

TABLE IV-1-VOLTAGE AND RESISTANCE MEASUREMENTS

Tube	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6**	Pin 7	Cap
V118	V 1900 R 5M	------	------	V 1900 R 5M	------	------	------	V2850 AC * R 170K
V117	V 1435 R 5M	V 1350 R ∞	V 1435 R 5M	V 1350 R ∞	V 1435 R 5M	------	V 1350 R ∞	------
V116	V 1350 R ∞	V 1266 R ∞	V 1350 R ∞	V 1266 R ∞	V 1350 R ∞	------	V 1266 R ∞	------
V115	V 1266 R ∞	V 1182 R ∞	V 1266 R ∞	V 1182 R ∞	V 1266 R ∞	------	V 1182 R ∞	------
V114	V 1182 R ∞	V 1097 R ∞	V 1182 R ∞	V 1097 R ∞	V 1182 R ∞	------	V 1097 R ∞	------
V113	V 1097 R ∞	V 1013 R ∞	V 1097 R ∞	V 1013 R ∞	V 1097 R ∞	------	V 1013 R ∞	------
V112	V 1013 R ∞	V 928 R ∞	V 1013 R ∞	V 928 R ∞	V 1013 R ∞	------	V 928 R ∞	------
V111	V 928 R ∞	V 844 R ∞	V 928 R ∞	V 844 R ∞	V 928 R ∞	------	V 844 R ∞	------
V110	V 844 R ∞	V 760 R ∞	V 844 R ∞	V 760 R ∞	V 844 R ∞	------	V 760 R ∞	------

LEGEND

* A-C voltage to terminal 3 of T102.

** No electrical connection to this pin. A voltage and high resistance to other pins normally may be measured due to internal leakage.

V Indicates d-c voltage to chassis ground unless otherwise specified.

R Indicates resistance to chassis ground unless otherwise specified.

Voltage and resistance measurements above are made with S102 set at +H.V. and S103 set at position "Q". A Simpson Model 260 Volt-Ohm-Milliammeter having an internal resistance of 20,000 ohms per volt DC and 1000 ohms per volt AC was used.

TABLE IV-1-VOLTAGE AND RESISTANCE MEASUREMENTS (cont.)

Tube	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6**	Pin 7	Cap
V109	V 760 R ∞	V 675 R ∞	V 760 R ∞	V 675 R ∞	V 760 R ∞	-----	V 675 R ∞	-----
V108	V 675 R ∞	V 591 R ∞	V 675 R ∞	V 591 R ∞	V 675 R ∞	-----	V 591 R ∞	-----
V107	V 591 R ∞	V 506 R ∞	V 591 R ∞	V 506 R ∞	V 591 R ∞	-----	V 506 R ∞	-----
V106	V 506 R ∞	V 422 R ∞	V 506 R ∞	V 422 R ∞	V 506 R ∞	-----	V 422 R ∞	-----
V105	V 422 R ∞	V 338 R ∞	V 422 R ∞	V 338 R ∞	V 422 R ∞	-----	V 338 R ∞	-----
V104	V 338 R ∞	V 253 R ∞	V 338 R ∞	V 253 R ∞	V 338 R ∞	-----	V 253 R ∞	-----
V103	V 253 R ∞	V 169 R ∞	V 253 R ∞	V 169 R ∞	V 253 R ∞	-----	V 169 R ∞	-----
V102	V 169 R ∞	V 84 R ∞	V 169 R ∞	V 84 R ∞	V 169 R ∞	-----	V 84 R ∞	-----
V101	V 84 R ∞	V 0 R 0	V 84 R ∞	V 0 R 0	V 84 R ∞	-----	V 0 R 0	-----

LEGEND

* A-C voltage to terminal 3 of T102.

** No electrical connection to this pin. A voltage and high resistance to other pins normally may be measured due to internal leakage.

V Indicates d-c voltage to chassis ground unless otherwise specified.

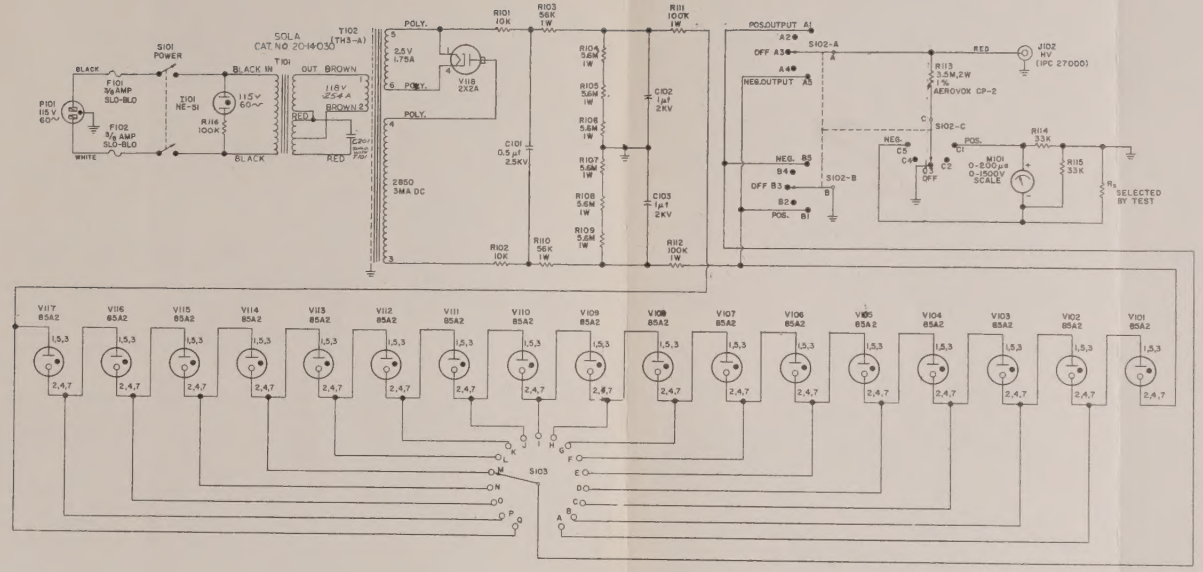
R Indicates resistance to chassis ground unless otherwise specified.

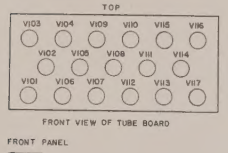
Voltage and resistance measurements above are made with S102 set at +H.V. and S103 set at position "Q." A Simpson Model 260 Volt-Ohm-Milliammeter having an internal resistance of 20,000 ohms per volt DC and 1000 ohms per volt AC was used.

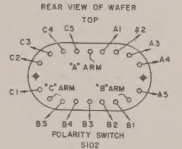
V. PARTS LIST

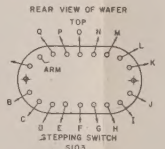
Symbol Designation	Description	B/A No.
C101	Capacitor, 0.5 mf, oil filled, 2.5 KV	00750
C102	Capacitor, 1 mf, oil filled, 2 KV	00609
C103	Capacitor, 1 mf, oil filled, 2 KV	00609
F101	Fuse, 3/8 amp, Slo-Blo (for 50 cps and 60 cps, 115 volt units)	00701
	Fuse, 3/16 amp, Slo-Blo (for 50 cps, 220 volt unit)	00758
F102	Fuse, 3/8 amp, Slo-Blo (for 50 cps and 60 cps, 115 volt units)	00701
	Fuse, 3/16 amp, Slo-Blo (for 50 cps, 220 volt unit)	00758
I101	Lamp, Pilot Assembly with red lens and NE-51	00854
J102	Connector, high voltage, coaxial	00698
M101	Meter	00981
	Meter face	00992
P101	Line cord and plug	00979
R101	Resistor, 10 K, 5%, 1/2 W, carbon comp.	00368
R102	Resistor, 10 K, 5%, 1/2 W, carbon comp.	00368
R103	Resistor, 56 K, 5%, 1 W, carbon comp.	00216
R104 thru R109	Resistor, 5.6 meg, 5%, 1 W, carbon comp.	00240
R110	Resistor, 56 K, 5%, 1 W, carbon comp.	00216
R111	Resistor, 110 K, 5%, 1 W, carbon comp.	00223
R112	Resistor, 100 K, 5%, 1 W, carbon comp.	00223
R113	Resistor, 3.5 meg, 1%, 2 W, film	00587

Symbol Designation	Description	B/A No.
R114	Resistor, 33 K, 1/2 W, 5%, carbon comp.	00345
R115	Resistor, 33 K, 1/2 W, 5%, carbon comp.	00345
R116	Resistor, 100 K, 1/2 W, 5%, carbon comp.	00319
R_x	Resistor, 1/2 W, 5%, carbon comp., value determined at factory	
S101	Switch, DPDT, Toggle	01348
S102	Switch, ceramic rotary	00367
S103	Switch, ceramic rotary	00369
T101	Transformer, constant voltage (matching capacitor supplied with transformer) (for 60 cps, 115 volt unit)	09660
	Transformer, constant voltage (with matching capacitor) (for 50 cps, 220 volt unit)	09662
	Transformer, constant voltage (with matching capacitor) (for 50 cps, 115 volt unit)	09661
T102	Transformer, high voltage	01476
V101 thru V117	Tube, 85A2, voltage reference	01488
V118	Tube, 2X2A, half-wave high-vacuum rectifier	01295









SCHEMATIC-1500 VOLT POWER SUPPLY
60 CYCLE, 115 VOLT, MODEL 312A BASIC

SCHEMATIC - 1500 VOLT POWER SUPPLY
60 CYCLE, 115 VOLT
MODEL 312A BASIC

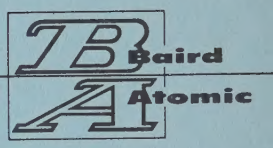
D- 08702 D

Warranty

Baird-Atomic, Inc. (the "Company"), warrants this equipment for a period of 1 year from the date of shipment as follows: it warrants that all equipment of its manufacture is free from defects in material and workmanship at the time of shipment. If within 1 year of shipment any equipment of the Company's manufacture develops defects in material or workmanship under normal conditions of operation, the buyer of the equipment may return it to the Company within 30 days of such failure, for repairs at the expense of the Company excluding transportation costs, or in the case of any defective part may return such part to the Company which will repair or replace the same at its expense excluding transportation costs. A further warranty of 1 year on the same terms shall be applicable to any part so repaired or replaced. Except for Dekatron glow tubes, this warranty does not extend to stock components not manufactured by the Company.

The Company shall not be liable for damage or destruction of instruments during delivery or caused by other than employees of Baird-Atomic, Inc.; in any event, liability shall not exceed the cost of replacement of defective parts upon prompt notification of such defect. For return of equipment or any part thereof under the terms of the foregoing warranty a letter should be forwarded to Baird-Atomic, Inc., Attention: Sales Service Department, 33 University Road, Cambridge 38, Massachusetts. It should state owner's name and address; model and serial number of equipment; the order number under which it was purchased; the date of failure and a description of the circumstances surrounding same. Upon receipt of such information, shipping instructions for return of equipment or parts thereof will be forwarded promptly.

Baird-Atomic, Inc.
33 UNIVERSITY RD., CAMBRIDGE 38, MASS.



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